

1

2,746,941

METHOD OF APPLYING NYLON FINISH TO GARMENTS

Robert S. Horn, Jr., Doylestown, and Roscoe F. Patt, Stony Creek Mills, Pa., assignors to Hans C. Bick, Inc., Reading, Pa., a corporation of Pennsylvania

No Drawing. Application November 21, 1951, Serial No. 257,652

2 Claims. (Cl. 260—9)

The present invention relates to a method of applying a nylon finish to nylon and other woven or knit fabrics in order to improve their wearing comfort and other qualities.

In recent years, nylon has been extensively used as a material for making garments because of its outstanding fast drying, substantially nonwrinkling, and long wearing characteristics. However, an outstanding undesirable characteristic of a nylon garment when worn in contact with the body, such as in the case of undergarments and hosiery, is that it does not readily absorb moisture, therefore, as a result, the garment will often feel hot and sticky in summer or cold and clammy in winter. This inability to absorb moisture can be readily observed by placing a drop of water on the surface of nylon fabric. The water will tend to remain in the form of a droplet, rather than be absorbed by the fabric as in the case of cotton, wool and other fabrics.

An object of the present invention is to provide a novel method or process of bonding nylon to nylon woven and knit fabrics so that they will be devoid of the above mentioned undesirable characteristic, more specifically, so as to make the fabric moisture absorbent.

A more specific object of the present invention is to provide a novel water emulsion of nylon which is suitable for bonding nylon to nylon fabric so as to convert the fabric from a nonabsorbing to an absorbing material and thereby provide an amazing increase in comfort in wear because of the ability of the finished garment to absorb perspiration, also which will give the garment a much softer and silkier touch.

Other objects and advantages of the present invention will become apparent from a study of the following description:

Many attempts have been made to apply a nylon finish to garments. However, they have not met with success from a commercial standpoint because nylon solvent solutions are required, many of which are inflammable or otherwise somewhat dangerous to handle as well as being quite expensive. Many attempts have been made to make water solutions or emulsions of nylon suitable for this purpose, but these have been unsuccessful. There has been a prevailing view that no satisfactory water emulsion of nylon can be made for treating fabrics, such as nylon fabrics, to improve their finish.

After considerable experimentation with this problem, we have been successful in compounding and mixing a solution of nylon dispersible in water to form a nylon emulsion in water which is highly successful when used in a finishing bath for garments, such as stockings, after the dyeing operation and which provides an amazing increase in moisture absorbing characteristics, therefore in wearing comfort.

Type 8 nylon, sold by E. I. du Pont de Nemours & Co., that is, nylon in dry, granular form, substantially powdery, or other suitable polyamid resin, can be successfully made into a solution which forms an emulsion when mixed with water and therefore useful in a finish-

2

ing bath by employing the following formula and process. Substantially equal parts, by weight, of Type 8 nylon (that is, nylon in granular, dry form which is N-methoxymethyl polyhexamethylene adipamide as described in U. S. Patent 2,430,860 to T. L. S. Cairns dated November 18, 1947, column 6 (Example I)), a nonionic emulsifying base and a partially stabilizing agent, such as a carbohydrate ester resin, for example resinous sucrose octaacetate, are mixed and stirred with a suitable alcohol, having a boiling point less than that of water such as methyl or alcohol, and thereafter this solution is mixed with water until a water emulsion is formed. More specifically, about thirty-five to forty-five pounds of Type 8 nylon sold under the trademark DV-55 and manufactured by E. I. du Pont de Nemours & Co., Wilmington, Delaware, is mixed with thirty-five to forty-five pounds of sucrose octaacetate and with thirty-five to forty-five pounds of Tergitol Dispersant NPG 101, such as produced by Carbide and Carbon Chemical Corporation (which is an alkyl phenyl ether of polyethylene glycol made by adding 7 to 12 mols of ethylene oxide to an alkyl phenol such as octyl phenol or nonyl phenol, or more specifically a non-ionic made by adding 9 to 10 mols of ethylene oxide to octyl phenol), and to this mixture is added eight hundred to nine hundred pounds of ethyl or methyl alcohol and two hundred to two hundred fifty pounds of water for making up the water emulsive nylon solution. Only a part of the alcohol, namely about two hundred pounds, is initially mixed with the nylon, sucrose octaacetate and the emulsifying nonionic base (Tergitol Dispersant NPG 101), and is stirred vigorously, preferably with a lightening mixer, so as to form a heavy paste. This heavy paste is then, more advantageously, added to another mixer with the balance of the alcohol (674 pounds), and stirred vigorously for about fifteen minutes. Water is then added at a temperature of between 140° to 180° F., preferably about 160° F. This is mixed until there are no lumps present and the liquid is clear, usually requiring between twenty and thirty minutes of mixing. The solution is then tested to determine whether a proper emulsion can be obtained. If the emulsion separates immediately, it will be necessary to add more base and alcohol. The emulsion is sieved through fine cloth.

In the above mentioned formula, it is generally desirable to have substantially equal parts by weight of nylon Type 8, sucrose octaacetate and the emulsifying nonionic base. A very suitable, specific formula for providing a water miscible solution of nylon for forming an emulsion is substantially as follows:

40 lbs. Type 8 nylon
40 lbs. sucrose octaacetate
40 lbs. emulsifying nonionic base, such as Tergitol Dispersant NPG
864 lbs. alcohol
216 lbs. water

It will be especially noted that the emulsifying base is nonionic as distinguished from cationic or anti-ionic compatible with nylon in an alcohol solution in order to provide a successfully emulsifying water miscible solution. Instead of the sucrose octaacetate, other suitable partially stabilizing agents may be used such as other esters of a carbohydrate and organic acid which is compatible with nylon and the emulsifying agent, and is completely soluble in an alcohol solution. Likewise, instead of Tergitol Dispersant NPG, other suitable emulsifying nonionic bases compatible with nylon in an alcohol solution may be used. Also, instead of Type 8 nylon, other suitable linear polyamide which are soluble in water-soluble alcohol may be used.

The above water emulsive nylon solution will have a flash point of 68° F., a fire point of 68° F. and a specific gravity of .881 at 77° F.

After a suitable water soluble, nylon emulsion is obtained in accordance with the process described hereinabove, this emulsion is used with other material in a finishing bath. The finish is applied after the dyeing operation and is set by the temperature of the bath in the case of woven goods and further set by a final boarding temperature in the case of stockings. The nylon emulsion is added with equal parts, by weight, of alcohol to the last rinse through a cloth sieve. More specifically, the following formula is used in the finishing bath for tricot and soft piece goods:

For 100 lbs. nylon hosiery, tricot or soft piece goods use:

- 1 lb. Bick F. A. (lauryl sulphate)
- 15 lbs. nylon, water emulsive solution
- 4 to 6 lbs. Methacrol NH (a cationic dispersion of polymethyl methacrylate produced and sold by E. I. du Pont de Nemours & Co.)
- 3 oz. citric acid

The finishing bath is started at about 85° F. and there is added dissolved Bick F. A. and the machine is run until a thorough mixture is obtained. The curing is effected while the goods are rotated in the machine, such as one used for dyeing, (for example, a Smith-Drum rotary hosiery drying machine). As a test, a 600 cc. beaker sample solution may be taken from the machine and about five to ten drops of the above described nylon water miscible solution is added which should make a perfect emulsion. If the emulsion should curd, sufficient alcohol (about 2 to 4 lbs.) is added to the water miscible nylon solution before adding the latter to the finishing bath. This addition, however, is seldom necessary. The water miscible nylon emulsion is then added to the machine, the temperature is raised to 95° F. and the machine is run for about five minutes, then dissolved Methacrol NH is added. The machine is run another five minutes and dissolved citric acid is added to aid in the curing process and the temperature is thereafter gradually raised to about 105° F. The machine is run about five minutes so as to extract and dry the treated cloth. Garments stay in the bath until the whitish emulsion is exhausted and the water clears—usually about ten minutes.

In order to obtain a firmer finish, there is added about six additional pounds of Methacrol NH. To obtain a very soft finish, Methacrol NH is omitted or about a half pound of Fara softener (a cationic softener with the fatty ester type) is added.

An alternate formula which is particularly useful for finishing hosiery is as follows:

For each 100 pounds of nylon hosiery that is dyed and thoroughly rinsed, use:

- 15 lbs. nylon water emulsive solution
- 2 lbs. alcohol
- 4 oz. citric acid
- 3 lbs. dull powder
- 3 lbs. Methacrol NH

The alcohol is added to the nylon water emulsive solution, the emulsion is then tested and added to the finish bath at a temperature of about 90° F. to 95° F. and the machine is run for about 5 minutes. The citric acid is dissolved and added slowly to the revolving machine. The dull powder is dissolved and added slowly to the finish bath, and the machine is run for about 5 minutes before adding the dissolved Methacrol NH. After the Methacrol has been added, the machine is run an additional 5 minutes, followed by the extracting and boarding operation.

For 30 denier stockings, a suitable solution is 20% nylon water miscible emulsion and for 15 denier stockings, 25% nylon water miscible emulsion, by weight.

The exact chemical reaction by which nylon is bonded to the nylon fabric in the curing process is not clear, but it appears that there is a chemical change between the emulsion, nylon fiber and the bonding agents causing the finish to become a part of the fiber itself.

The finish cannot be seen, that is, there is virtually no change in appearance between treated and untreated nylon fabric. The finish gives a slightly duller appearance to the nylon fabric and a different feel, especially when wet. Also, it imparts a softer and silkier feel as well as pliability and warmth not usually associated with untreated fabric. The finish enables the fabric to absorb and disperse moisture much faster than untreated garments by capillary action. This quick absorption and spreading of the moisture removes perspiration immediately from the skin and speeds evaporation. This does away with the feeling of stickiness or clamminess usually associated with nylon fabric and makes the garment much more comfortable to wear.

Thus it will be seen that we have provided a novel formula which for the first time, so far as we are aware, enables the making of a water miscible nylon emulsion, which emulsion is useful in a finishing bath to give the nylon material being treated amazing water absorbing characteristics which will enable nylon garments for the first time to readily absorb moisture or perspiration from the body when worn, thereby giving substantially greater comfort to the wearer both in winter and summer. Thus treated nylon is made suitable for year around comfortable year. While the above described process is highly useful in treating nylon woven and knit fabrics, it is also useful for treating other materials such as rayon, acetates and wool, the felting and shrinking characteristics of the latter being prevented by finishing by the process described herein. Not only is the nylon or other fabric converted from a nonabsorbing to an absorbing material, insofar as body perspiration is concerned, but it has additional highly useful characteristics such as highly improved snag, flexing and abrasion ratings as compared to those of harsher resin finishes. Also, the bursting strength is substantially greater than fabrics having other finishes. Nylon fabric treated by the process described herein is considerably more flexible, being more flexible after washing than untreated fabric and also having satisfactory stretch durability. Furthermore, the desirable fast drying characteristic of nylon is not appreciably affected by the process described herein, hence stockings and other clothing treated by the present process will dry with great speed.

While the above described formulas and processes are characteristic of the present invention, it will be apparent to those skilled in the art that departures may be made in both insofar as the specific materials used, the percentage composition, and the specific steps of the process without departing from the spirit of the present invention as covered by the following claims.

We claim:

1. A solution for forming an aqueous emulsion when mixed with large quantities of water so as to deposit a linear polyamide coating on textiles when immersed in the emulsion, comprising, in proportion by weight: about 200 to 250 lbs. of water, about 800 to 900 lbs. of an alcohol having a boiling point less than 100° C. having dissolved therein about 35 to 45 lbs. of N-methoxymethyl polyhexamethylene adipamide, about 35 to 45 lbs. of a nonionic, surface active, emulsifying agent and about 35 to 45 lbs. of a partially stabilizing ester of a carbohydrate and organic acid, which will remain completely dissolved in said solution.

2. A solution suitable for forming an emulsion when mixed with water for treating fabrics, comprising the fol-

5

lowing composition in the following proportions by weight: about 35 to 45 lbs. N-methoxymethyl polyhexamethylene adipamide; 35 to 45 lbs. sucrose octaacetate; 35 to 45 lbs. of an alkyl phenyl ether of polyethylene glycol wherein the alkyl group is selected from the group consisting of octyl and nonyl radicals; 800 to 900 lbs. of

6

an alcohol having a boiling point less than 100° C.; and about 200 to 250 lbs. of water.

References Cited in the file of this patent**UNITED STATES PATENTS**

2,405,965 Leekley ----- Aug. 20, 1946